

# CONTROL DESIGN AND FUNCTIONAL TESTING GUIDES

## Building Commissioning and the Control Design and Functional Testing Guides

Although many buildings are designed to be energy-efficient, they often don't meet design expectations once they are built. One way to recover this lost energy is to implement better control designs and specific procedures for testing the installed air-handling systems.

Two guides for improving these processes are now available:

- *Control System Design Guide*
- *Functional Testing Guide for Air Handling Systems: From the Fundamentals to the Field*

Control systems usually cause the most problems in a building. The *Control System Design Guide* has a toolbox of templates for improving control system design and specification.

The *Functional Testing Guide* helps readers attain a practical understanding of commissioning air-handling system fundamentals, and the benefits of functional testing.

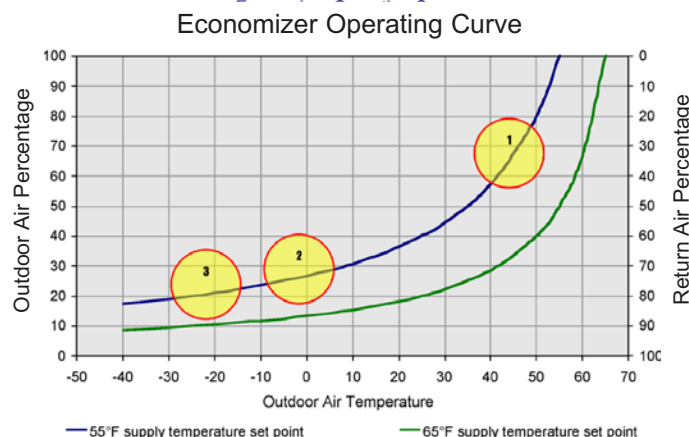
Commissioning air handling systems can:

- improve building performance
- reduce energy use
- improve indoor air quality
- increase occupant comfort and productivity.

## What the Functional Testing Guide Can Do for You

The *Functional Testing Guide* allows easy access to the many functional tests collected in the *Commissioning Test Protocol Library* (CTPL) developed by Pacific Gas & Electric Company. The CTPL is the largest existing collection of functional test procedures, including many non-copyrighted test procedures that can be customized to suit individual system configurations. Since the test procedures in the CTPL do not include detailed explanations, the *Functional Testing Guide* explains the "how" and "why" behind the functional tests in the CTPL.

The Guides provide details on air handler component design and operations. The example illustrates how economizers operate. The amount of outdoor air needed to maintain a supply temperature set-point depends on the outdoor air temperature (Circles 1 and 2). Typical office environments do not require preheat until it is cold outside (Circle 3). Most economizers in California buildings do not perform at optimal levels; understanding their operation can lead to significant energy savings.



## Who Benefits?

The operating cost of a commissioned building can be 20% or more below that of a non-commissioned building. The one-time investment in commissioning for a building (ranging from 0.5–1.5% of construction costs) can reduce the operating costs over the entire life of the building.

The *Guides* help maximize energy savings from commissioning by improving the process of identifying and fixing common air handler problems.

## Air Handler Components Covered in the Functional Testing Guide

Outdoor Air Intake	Warm-up
Fan Casing	Fans and Drives
Economizer and Mixed Air	Distribution
Filtration	Terminal Equipment
Preheating	Return, Relief, and Exhaust
Cooling	Scrubbers
Humidification	Control of Fire and Smoke
Reheat	Integrated Operation and Control

- If one percent of all buildings used the tool to reduce energy consumption by 5%, first-year savings of 45 GWh are achievable.
- If the market penetration increased by one percent per year, the ten-year cumulative savings would reach 2,500 GWh.

# INTERESTED?

## Control Design and Functional Testing Guides

- **Commissioning providers** can use the Functional Testing Guide for both new and existing buildings to develop and customize their own tests.
- **Building owners and operators** can use these Guides to better understand how to lower energy costs, improve indoor environmental quality, and increase their building operations expertise.
- **Designers** are the primary audience for the Control System Design Guide and will benefit from portions of the Functional Testing Guide that relate to design issues.



*Air handler on site, prior to installation and commissioning*

The *Guides* are available at:  
<http://buildings.lbl.gov/hpcbs/FTG>

This project is part of LBNL's High-Performance Commercial Building Systems program, a three-year public-private research initiative targeting substantial reductions in the energy costs of commercial buildings.

For access to all program results, see:  
<http://buildings.lbl.gov/hpcbs>



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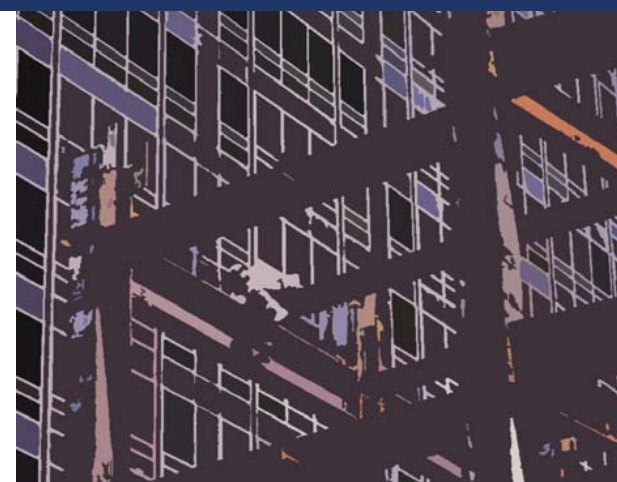
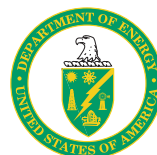
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## CONTROL SYSTEM DESIGN GUIDE & FUNCTIONAL TESTING GUIDE FOR AIR-HANDLING SYSTEMS

